Atty. Docket No. SHA01 P-361

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit	:	2655
Examiner	:	Gregory A. Blankenship
Applicant	:	Scott C. Glasgow et al.
Appln. No.	:	10/808,127
Filing Date	:	March 24, 2004
Confirmation No.	:	4520
For	:	ENERGY MANAGEMENT BEAM

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Dear Sir:

DECLARATION UNDER 37 C.F.R. § 1.131

We, the undersigned, declare as follows:

1. We are the co-inventors of the claims of the above-identified patent application.

2. Prior to February 4, 2004, we conceived of the invention as defined in claims 1-4-9, 13, 16-24, 28, 31-40, 44, 47 and 49-51. Evidence of our conception is provided in the form of PowerPoint presentation (copy attached as Exhibit A) that we prepared following our conception. The PowerPoint presentation is dated before February 4, 2004.

3. On March 24, 2004, the present invention was constructively reduced to practice as that is the filing date of the present application.

4. All of the above activities outlined above occurred in the United States.

The undersigned hereby declare that all statements made herein of their own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

By: Scott C. Glasgow

Scott C. Glasgow

12/20/07

Dated

By: David W. Heatherington

David W. Heatherington

12/20/07

Dated

By: Bruce W. Lyons

Bruce W. Lyons

12/20/07

Dated

Energy Management Beam

EMB Development Notes

Shape Corporation - January 28, 2004

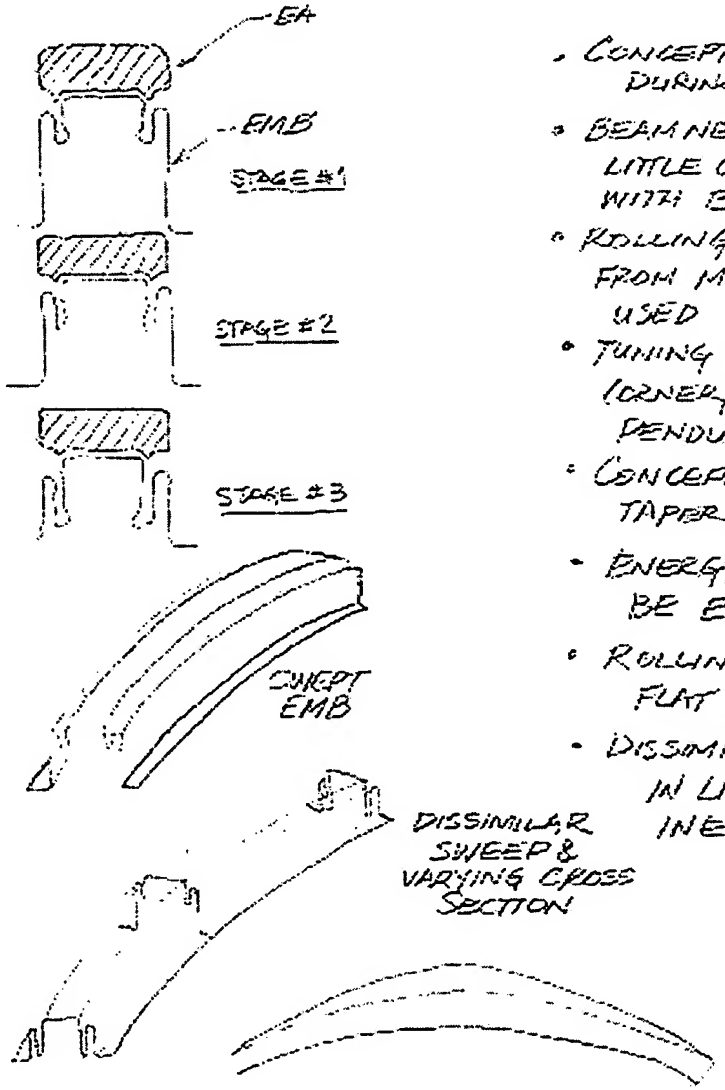
Scott Glasgow

David Heatherington

Bruce Lyons

The next slide contains initial concept drawings. Note that the initial concept was for a one piece section that incorporated the rolling technology. The beauty of the concept was for beam sections that needed taper at the end, the ends could be struck in production (initiate roll) and this would provide tapered ends. The section was intended to be flat between the rails, but we also felt that the section could be swept in our inline sweeping process.

ENERGY MANAGEMENT BUMPER - EMB

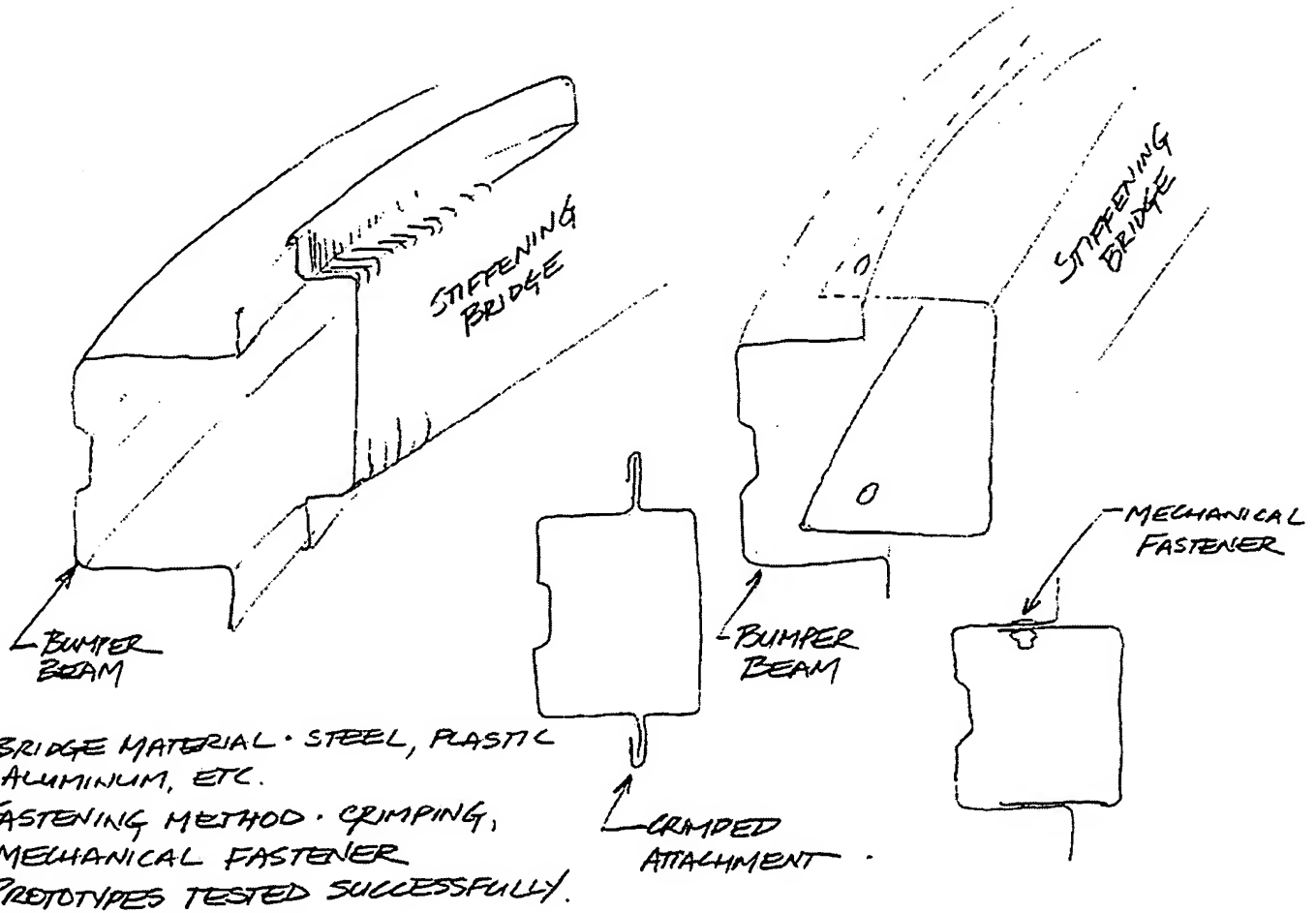


- CONCEPT IS TO USE AN ACTIVE ROLLING DEFORMATION DURING IMPACT
- BEAM NEEDS TO BE STIFF TO PROMOTE ROLLING WITH LITTLE OR NO SWEEP LOSS - THIS IS MOST LIKELY DONE WITH BRIDGE IN BEAM BACK FACE
- ROLLING WOULD BE TUNED USING VARIOUS MATERIALS FROM MILD TO UHSS. ALTERNATIVE STEELS CAN BE USED
- TUNING WOULD PROMOTE ROLLING DURING FLAT/POLE/CORNER/ART TESTING AND NOT DURING LOWER ENERGY PENDULUM TESTS
- CONCEPT ALLOWS FOR DISSIMILAR SWEEP (STYLING - TAPERED ENDS) AND VARING CROSS SECTIONS
- ENERGY ABSORBER INITIATES ROLLING. EA COULD BE EPP FOAM AND/OR PLASTIC
- ROLLING PROCESS IS HIGHLY EFFICIENT WITH FLAT LINE LOADING DURING ROLLING PROCESS.
- DISSIMILAR SWEEP COULD POSSIBLY BE DONE IN LINE, FED DIRECTLY FROM LINE OR THROUGH INEXPENSIVE SECONDARY. (IE. NOT A PRESS)

ADVANCED PRODUCT DEVELOPMENT TEAM - 6/18/03 David L. Washington
DAVID HEATHERINGTON, SCOTT GUSSON, BRUCE LYONS

The next slide shows a concept of attaching a bridge to the back of an open section (C-section). The bridge provides backbone to the open section by restricting the top/bottom legs from coming out of plane during impact. In the past the bridges have been welded either using MIG or resistance welding. This concept of crimping a bridge was used on the EMB single piece section to provide more rigidity to the system.

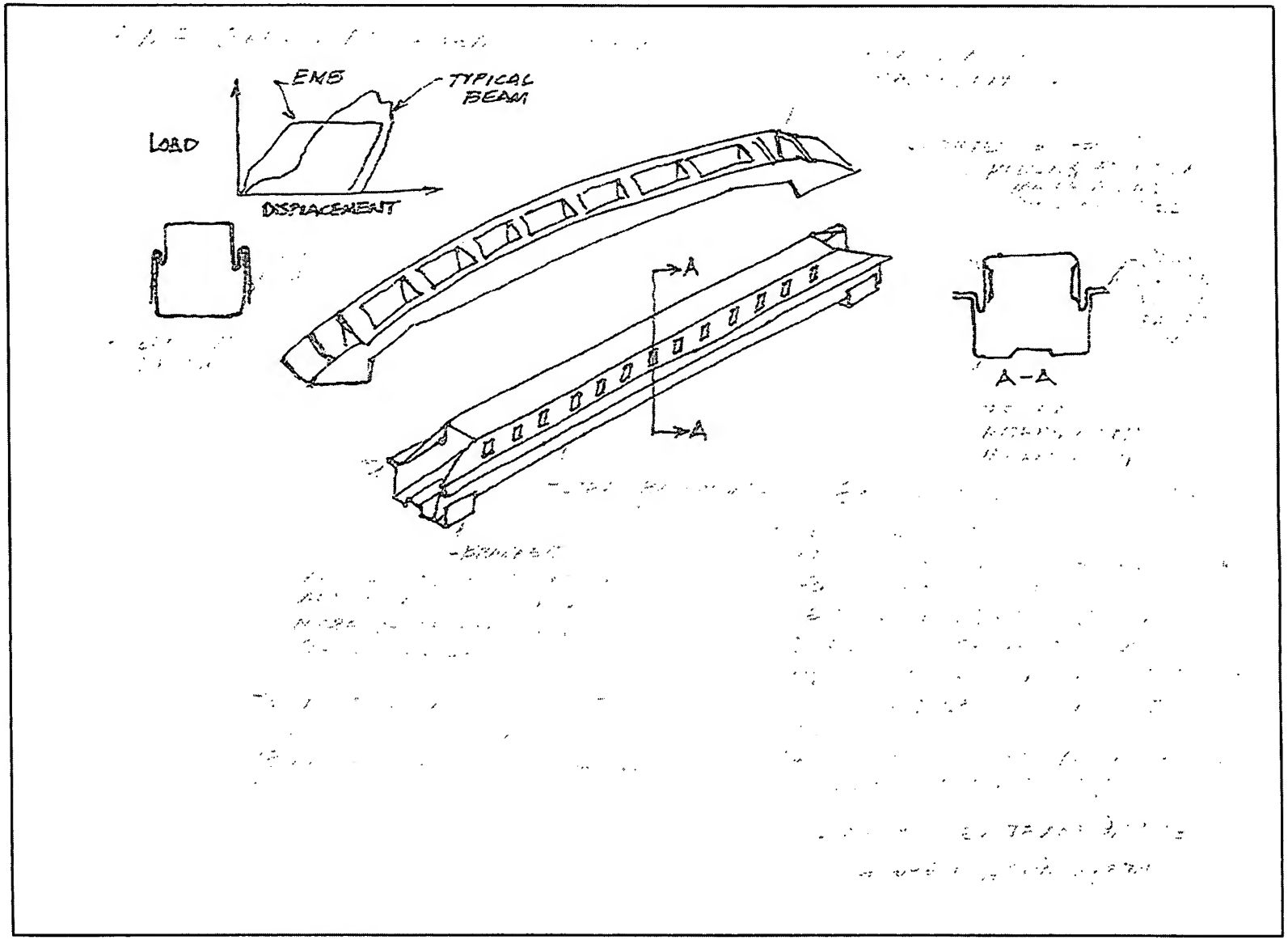
STIFFENING BRIDGE ATTACHMENT TO BUMPER BEAM



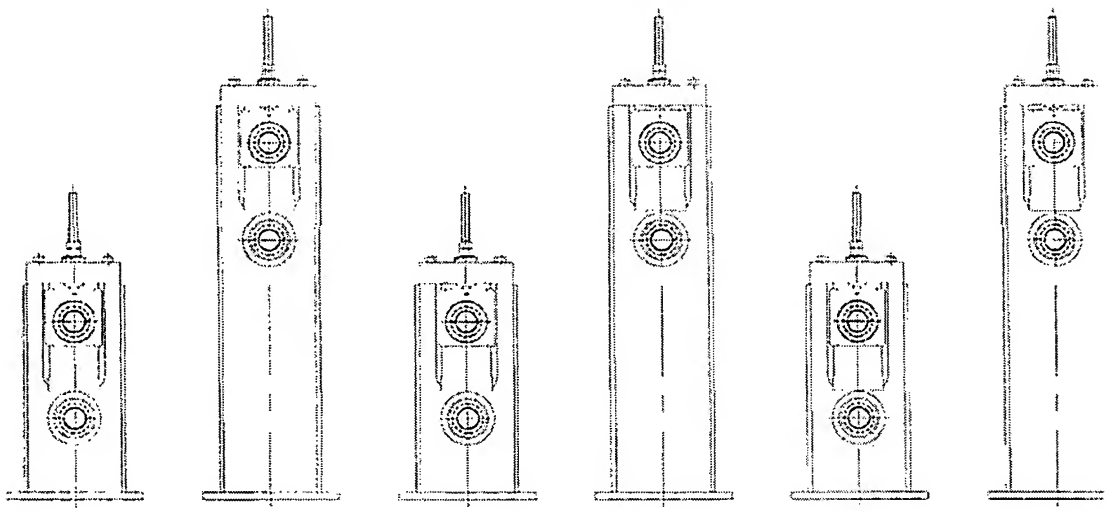
- BRIDGE MATERIAL - STEEL, PLASTIC ALUMINUM, ETC.
- FASTENING METHOD - CRIMPING, MECHANICAL FASTENER
- PROTOTYPES TESTED SUCCESSFULLY.

ADVANCED PRODUCT DEVELOPMENT TEAM 6/3/03 David A. Heatherington
DAVID HEATHERINGTON, BRUCE LYONS, SCOTT GLASGOW

The next slide is the section design that we carried forward in development. The design in the drawings have gone through some miner changes along the way, but the concept and over shape have not changed. There is a duplicate effort going on that uses aluminum and the geometry has is quit different due to the fact that the product would be extruded and roll formed.


EMB
TYPICAL BEAM
LOAD
DISPLACEMENT
A
A
A-A

EMB Manufacturing Notes



H:\Engineering\WITTED\DOUBLEHIGH MILL.dwg, 10/13/2003 02:11:24 PM, \\Shape100\18_

16 forming passes

Plus 4 joining passes

(each section)

One possible manufacturing process is that pictured above - the two sections are rolled simultaneously and after the shapes are formed, they are brought together and assembled. Assembly could be via welding, crimping or mechanical fastener.

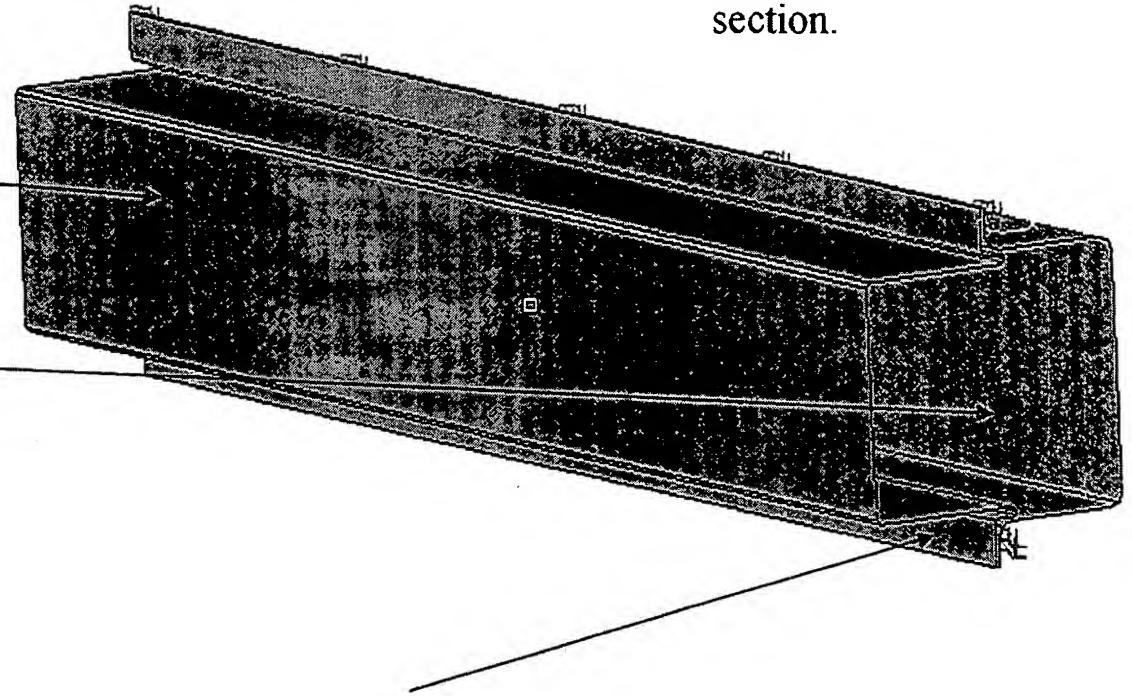
EMB

2- Piece Design

Upon impact front face is designed to roll into base section.

Front Face:
Material = 1.2mm, 50ksi

Base:
Material = 2.5mm, 80ksi

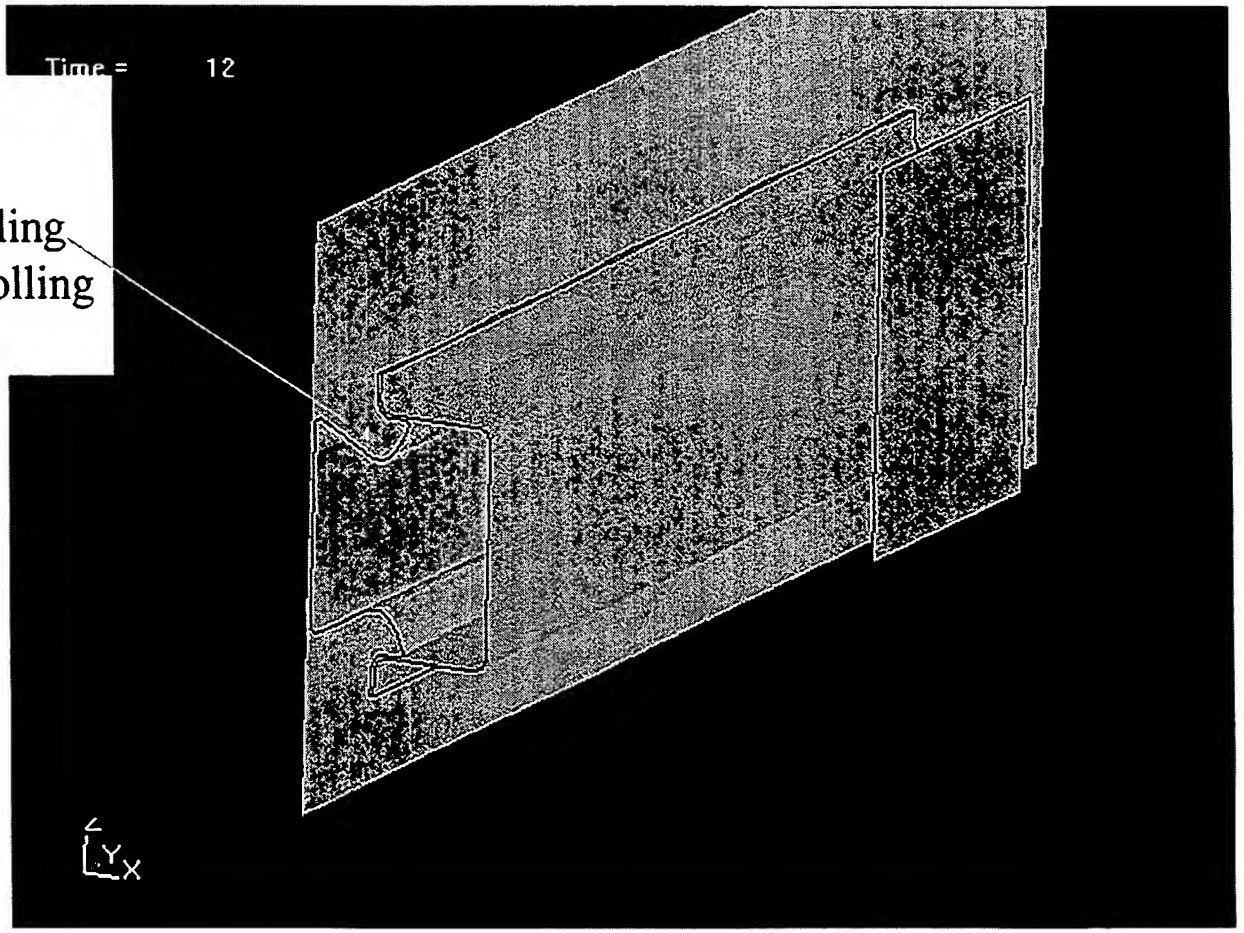


Section are attached by crimping the flanges together.
Welding could also be used to bond the flanges.

R030819rev2
Flat Barrier Impact
No E/A

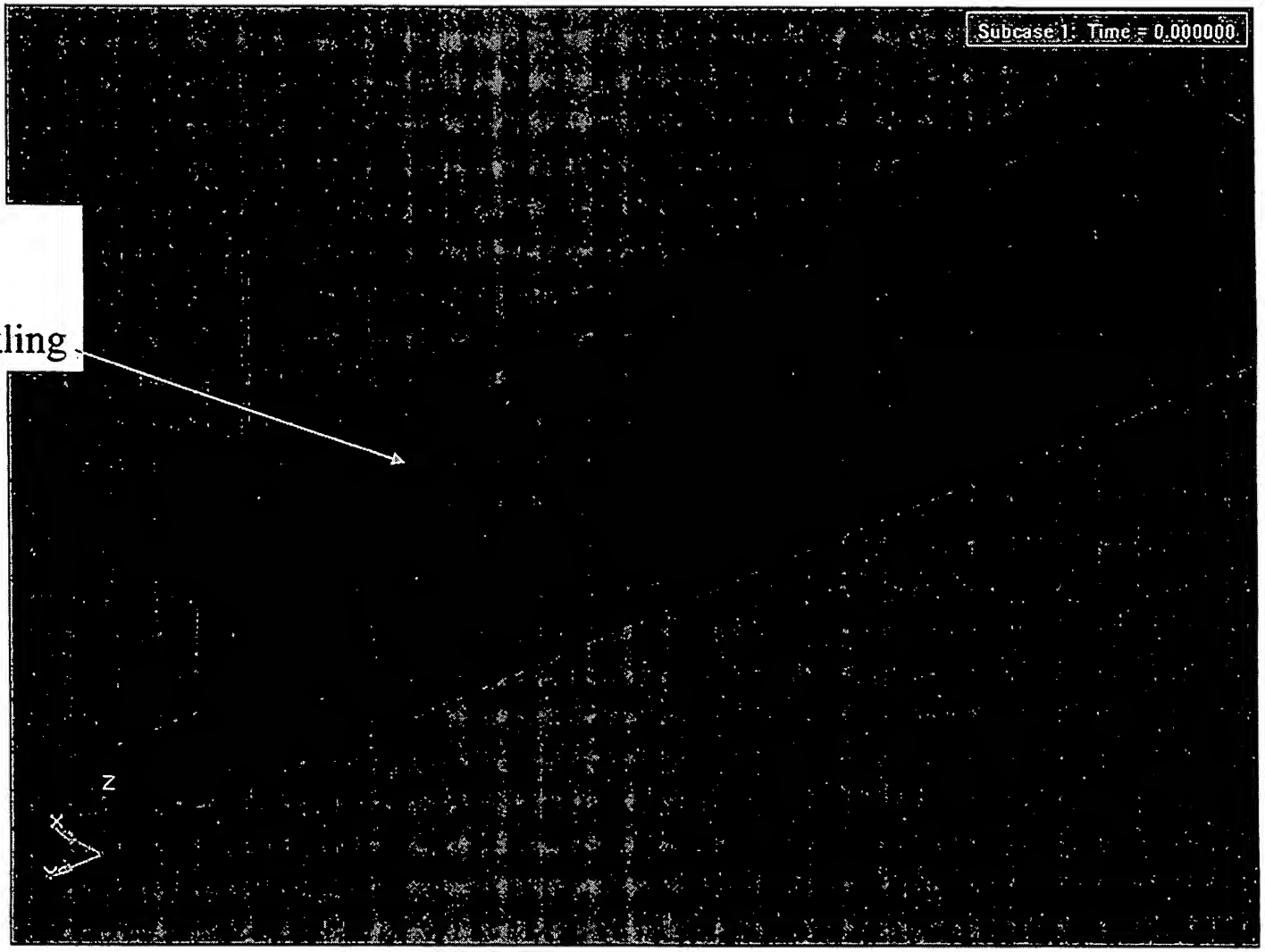
Notes:

Wall is buckling rather than rolling the radius



Revised Design

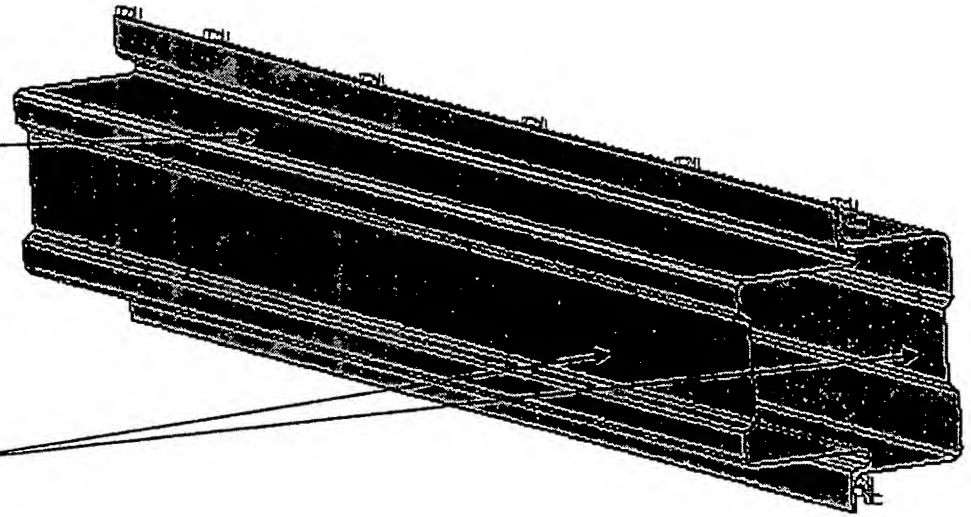
Added ribs
to prevent buckling



Revised Design

Lowered rib design for improved manufacturing and part function

Added rib to front face and base sections for added strength



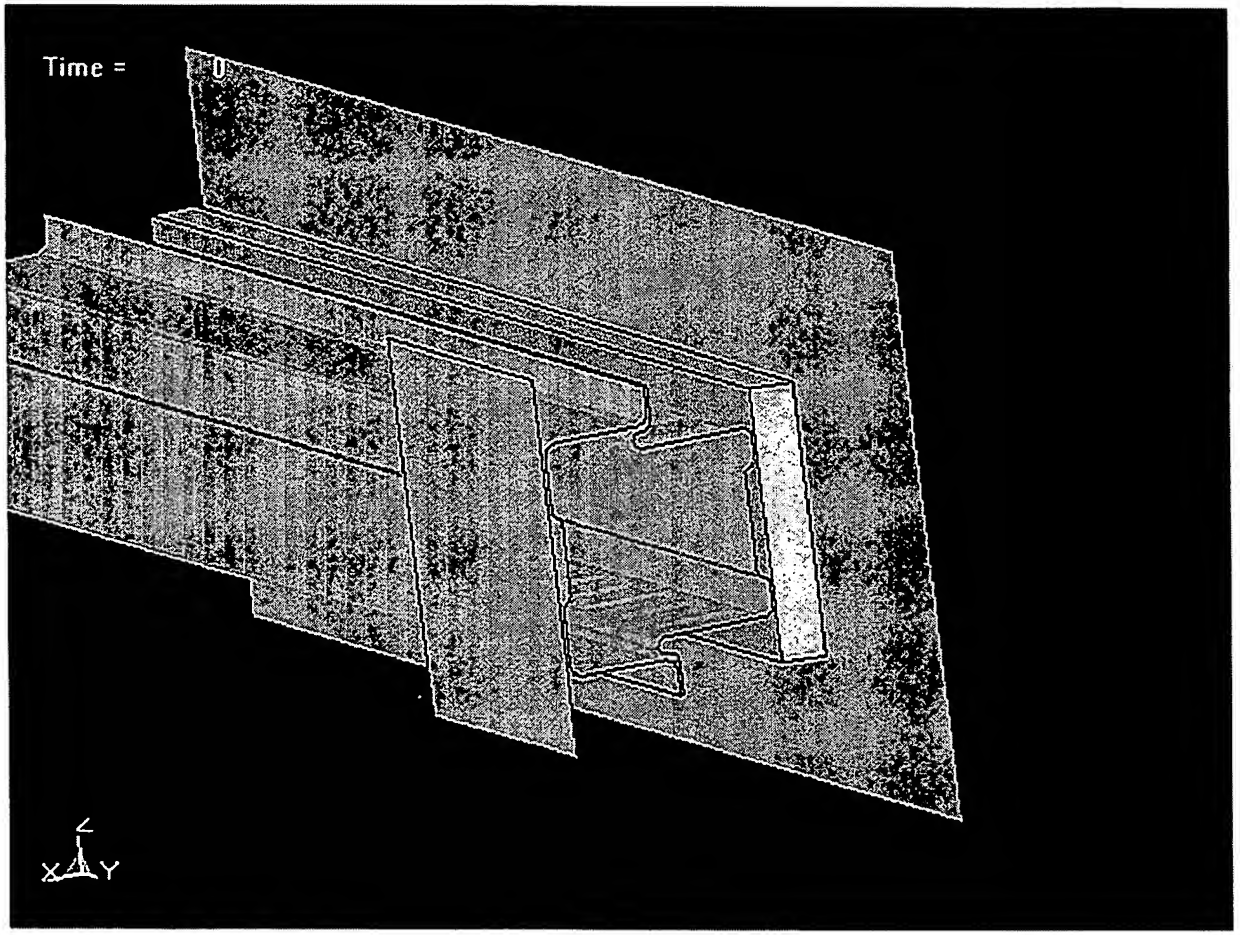
Non-Swept System(m:/rev17/rev26)
Flat Barrier Impact

Notes:

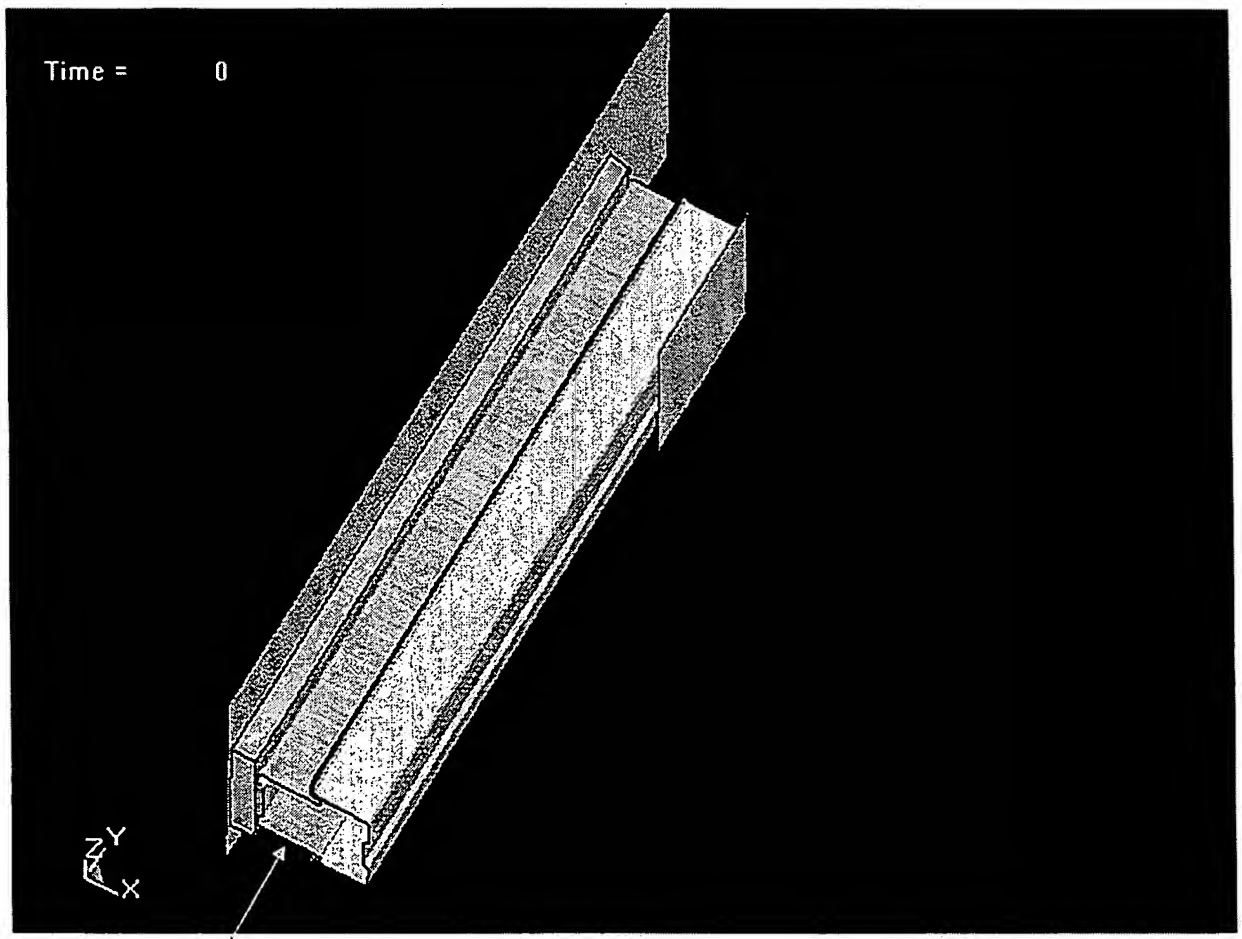
Beam Base:
2.5mm, 80ksi

Front Face:
1.2mm, 50ksi

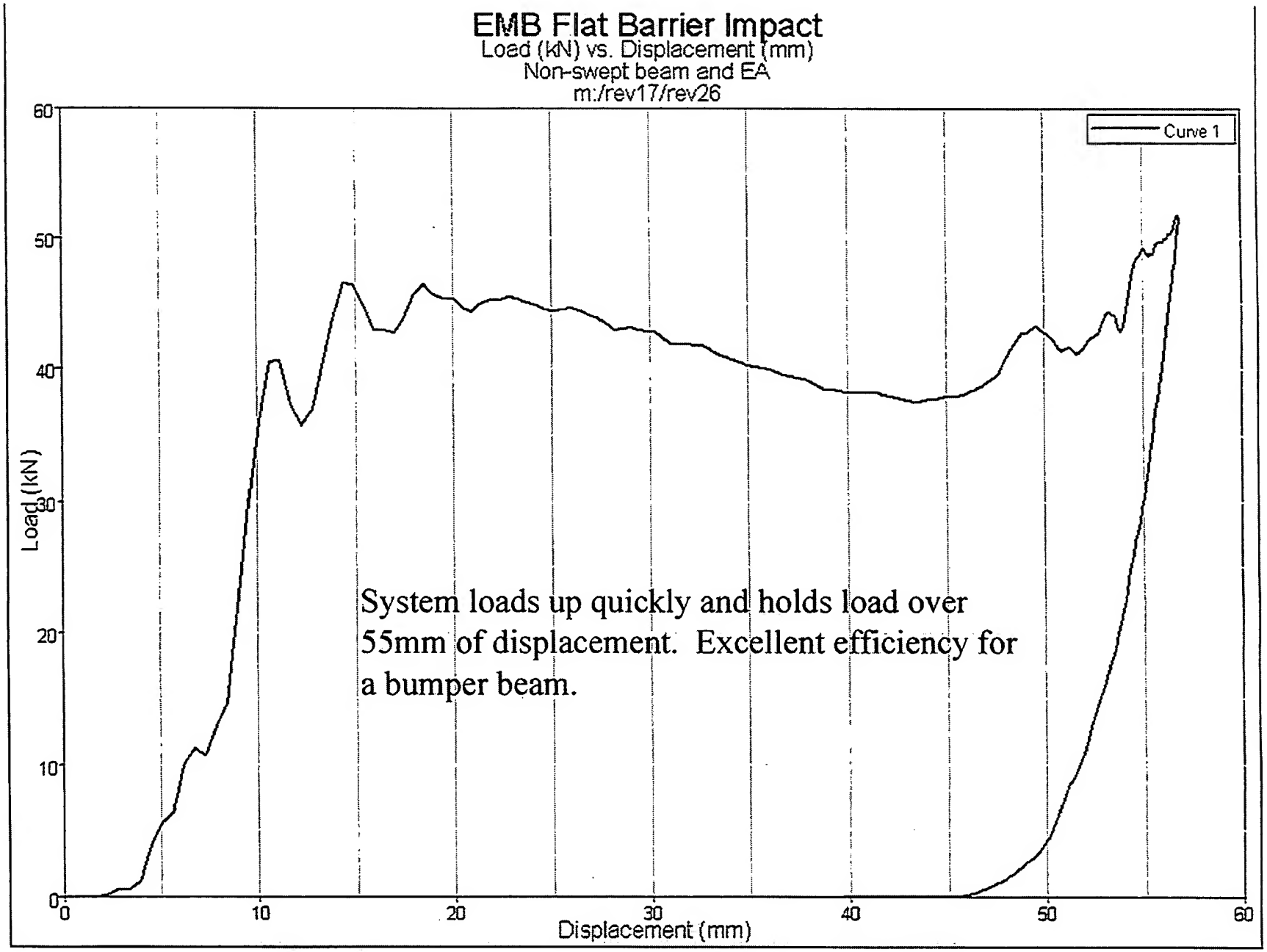
E/A:
Flat high density
foam. 10.8pcf



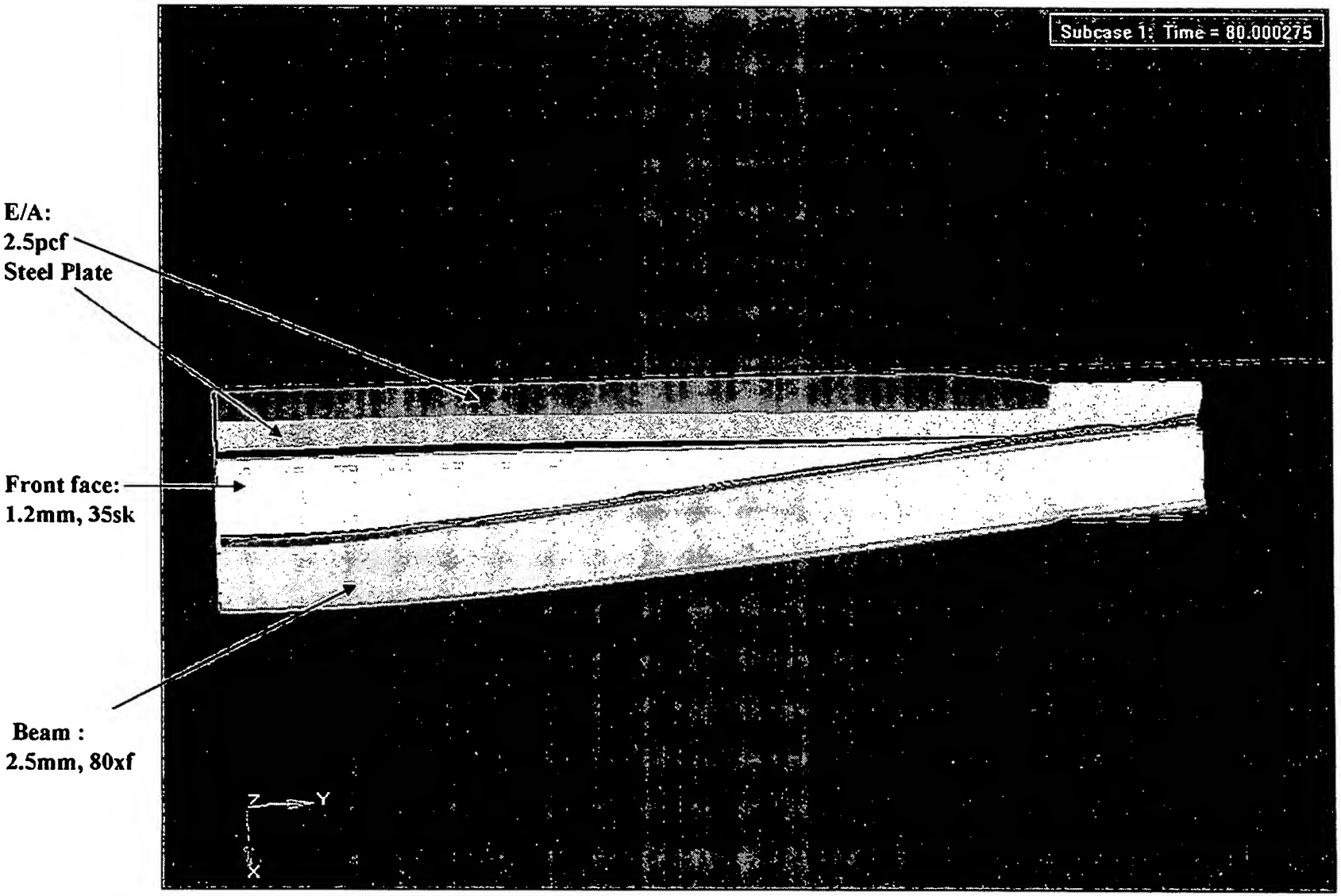
Non-Swept System(m:/rev17/rev26)
Flat Barrier Impact

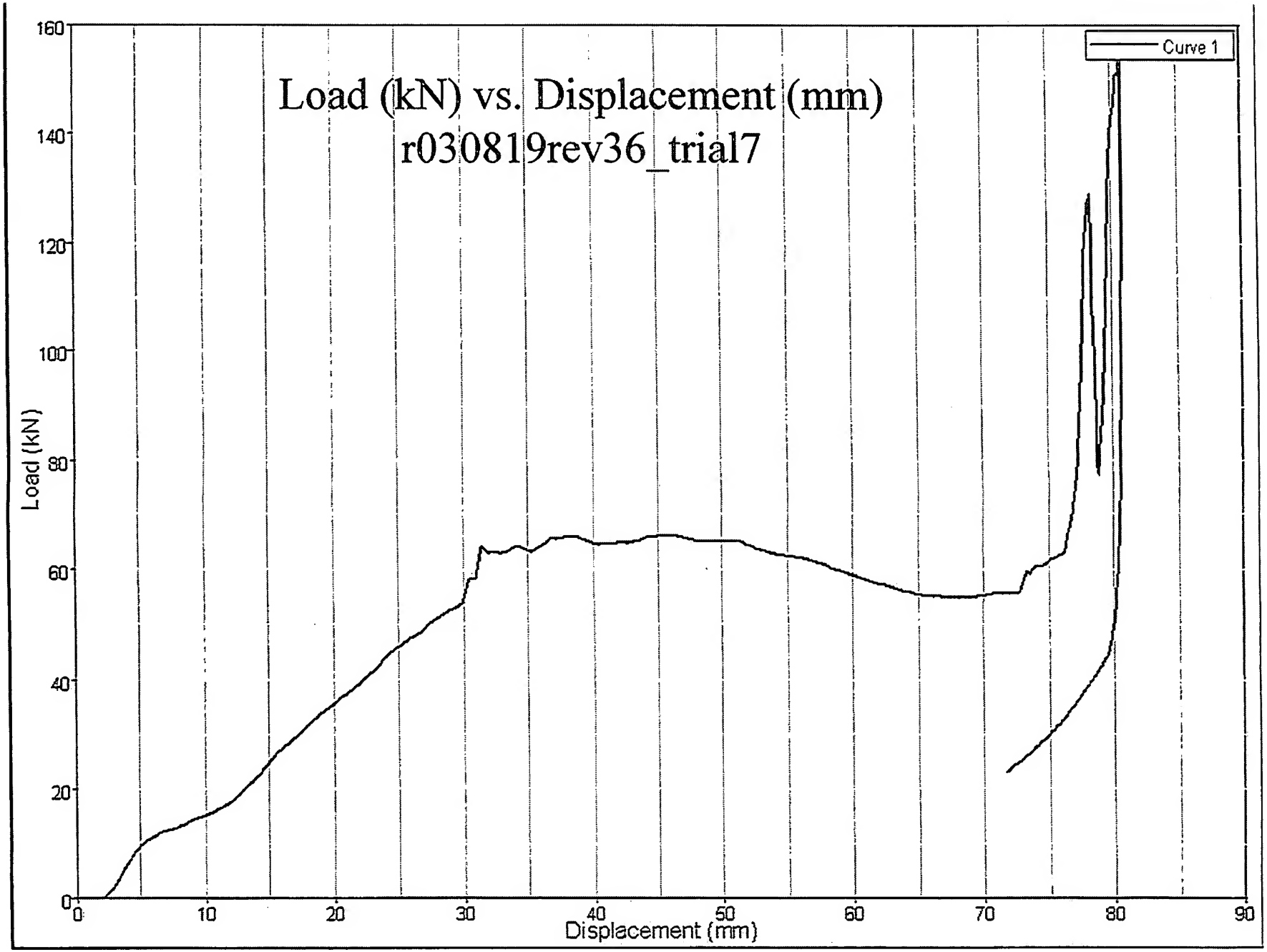


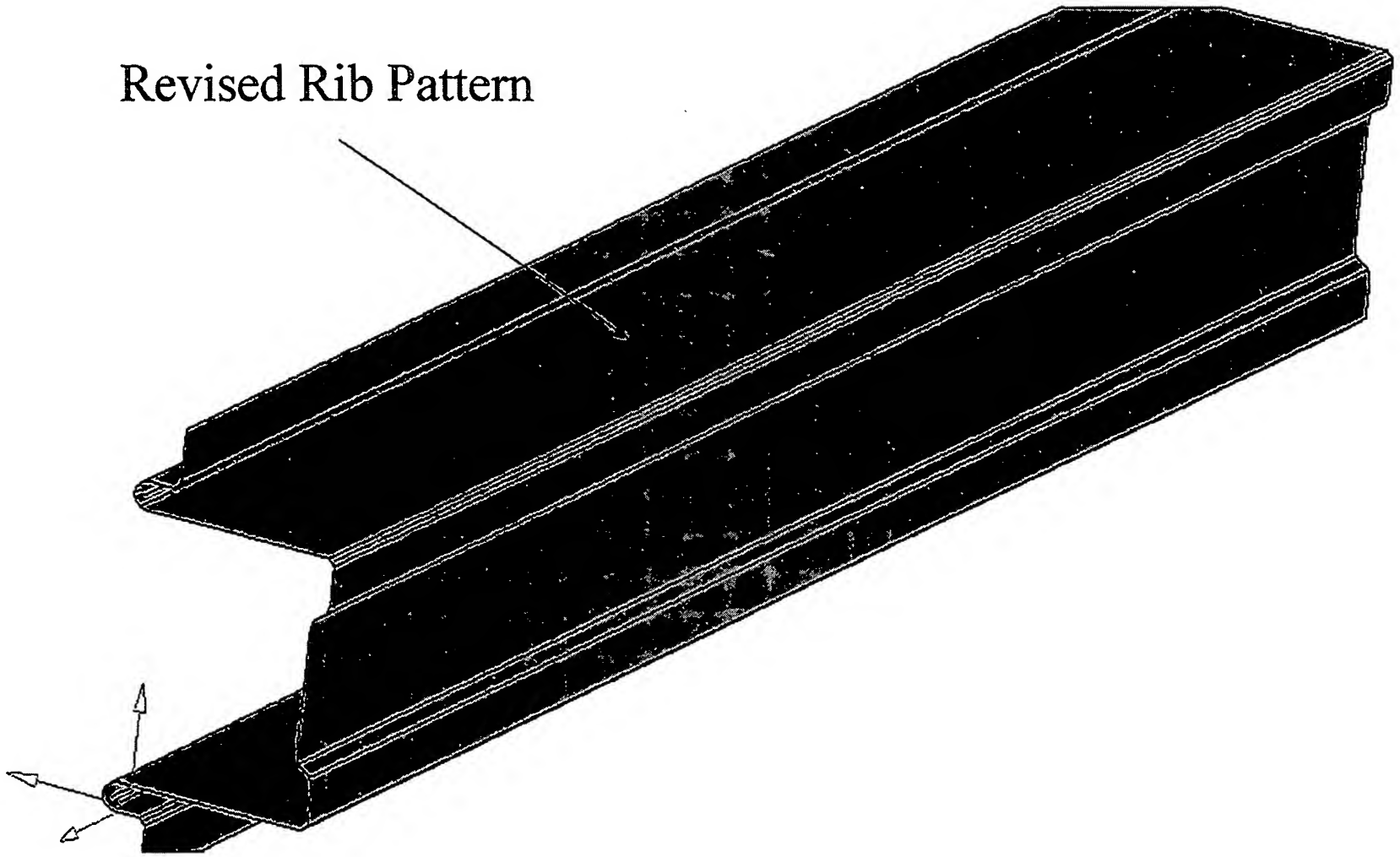
Beam opens at center

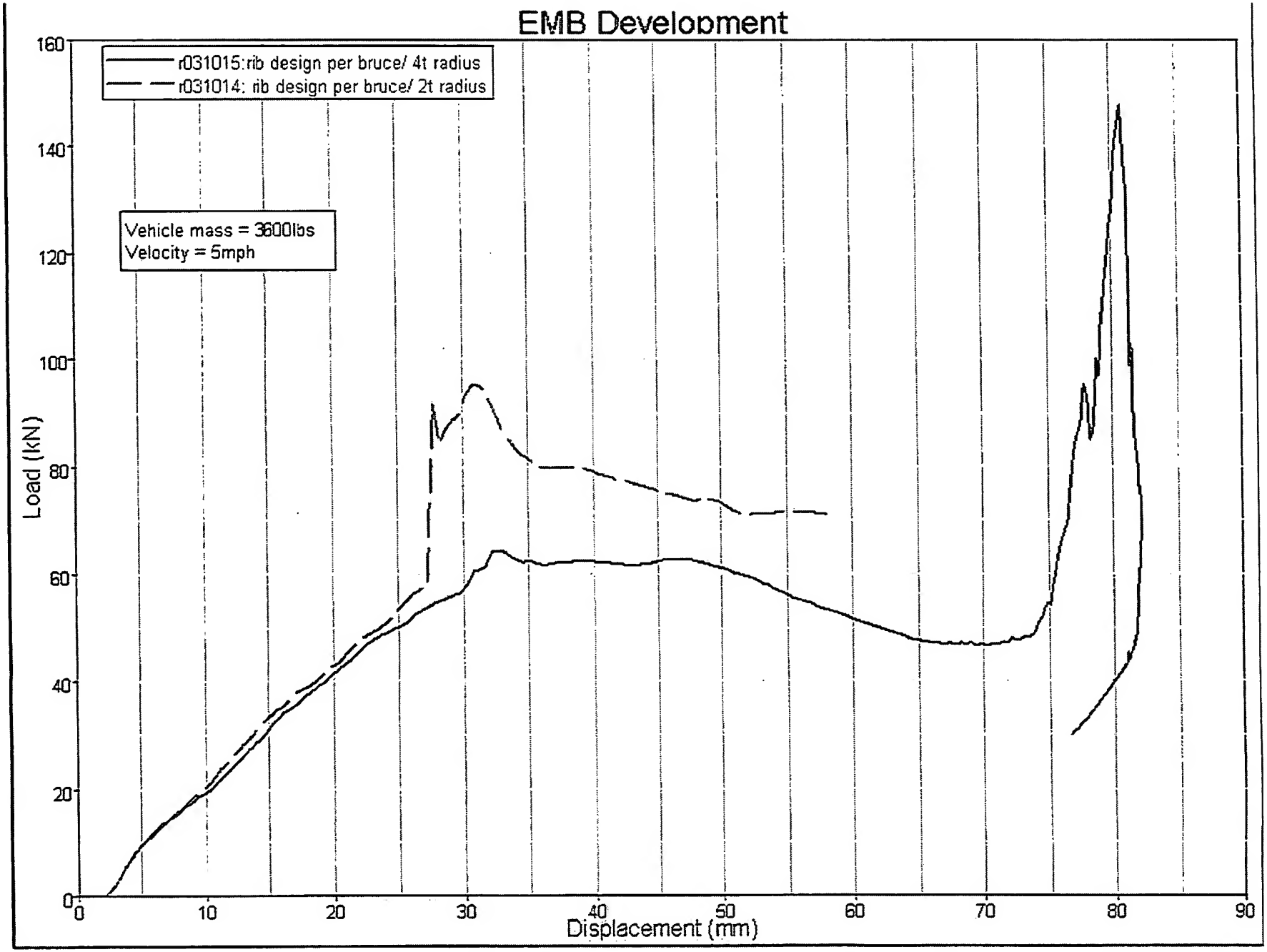

EMB Flat Barrier Impact
Load (kN) vs. Displacement (mm)
Non-swept beam and EA
m:/rev17/rev26
Curve 1
Load (kN)
Displacement (mm)
0
10
20
30
40
50
60
System loads up quickly and holds load over 55mm of displacement. Excellent efficiency for a bumper beam.

r030819rev36_trial7

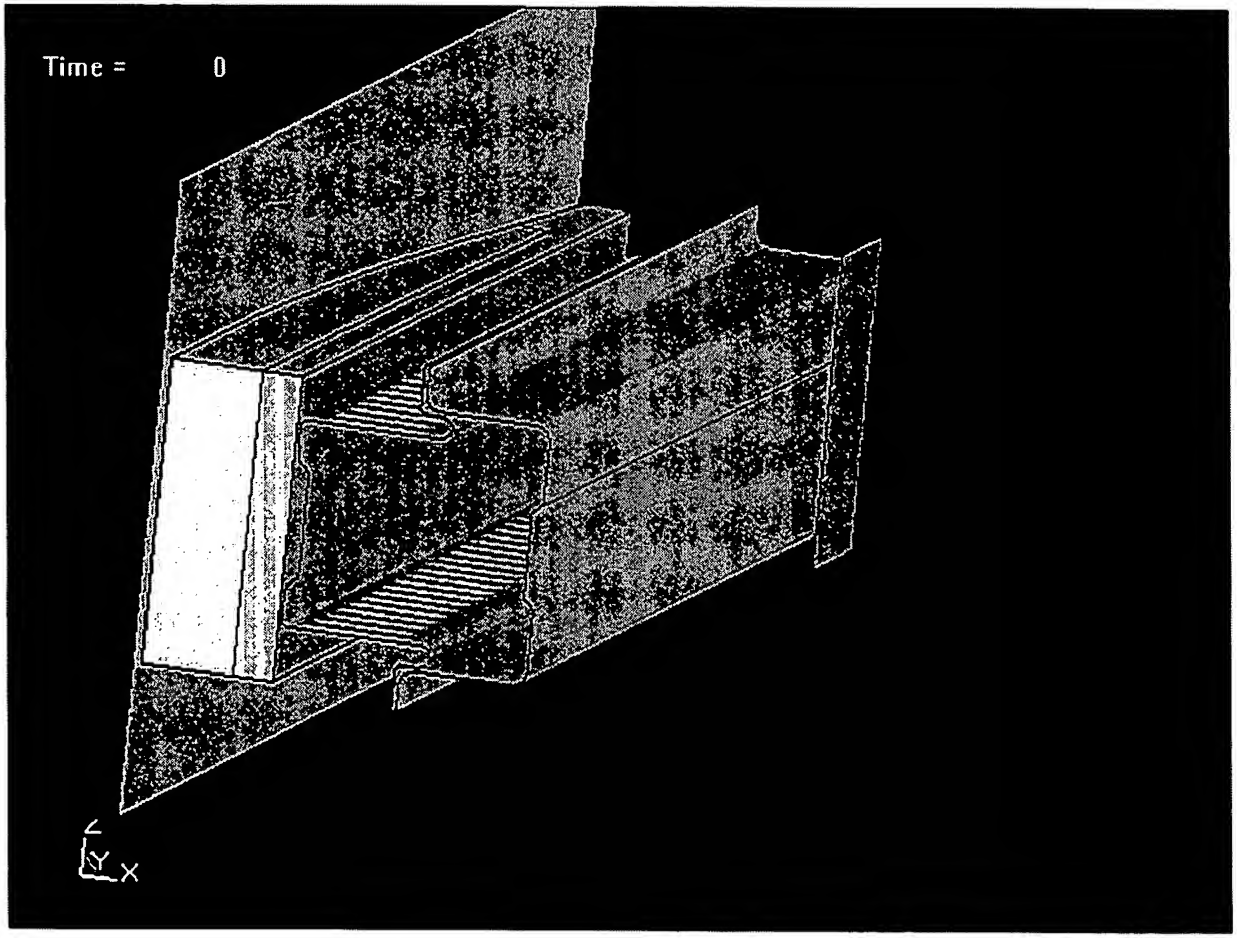



Load (kN) vs. Displacement (mm)
r030819rev36_trial7
Curve 1
Load (kN)
Displacement (mm)
0
20
40
60
80
100
120
140
160
0
10
20
30
40
50
60
70
80
90

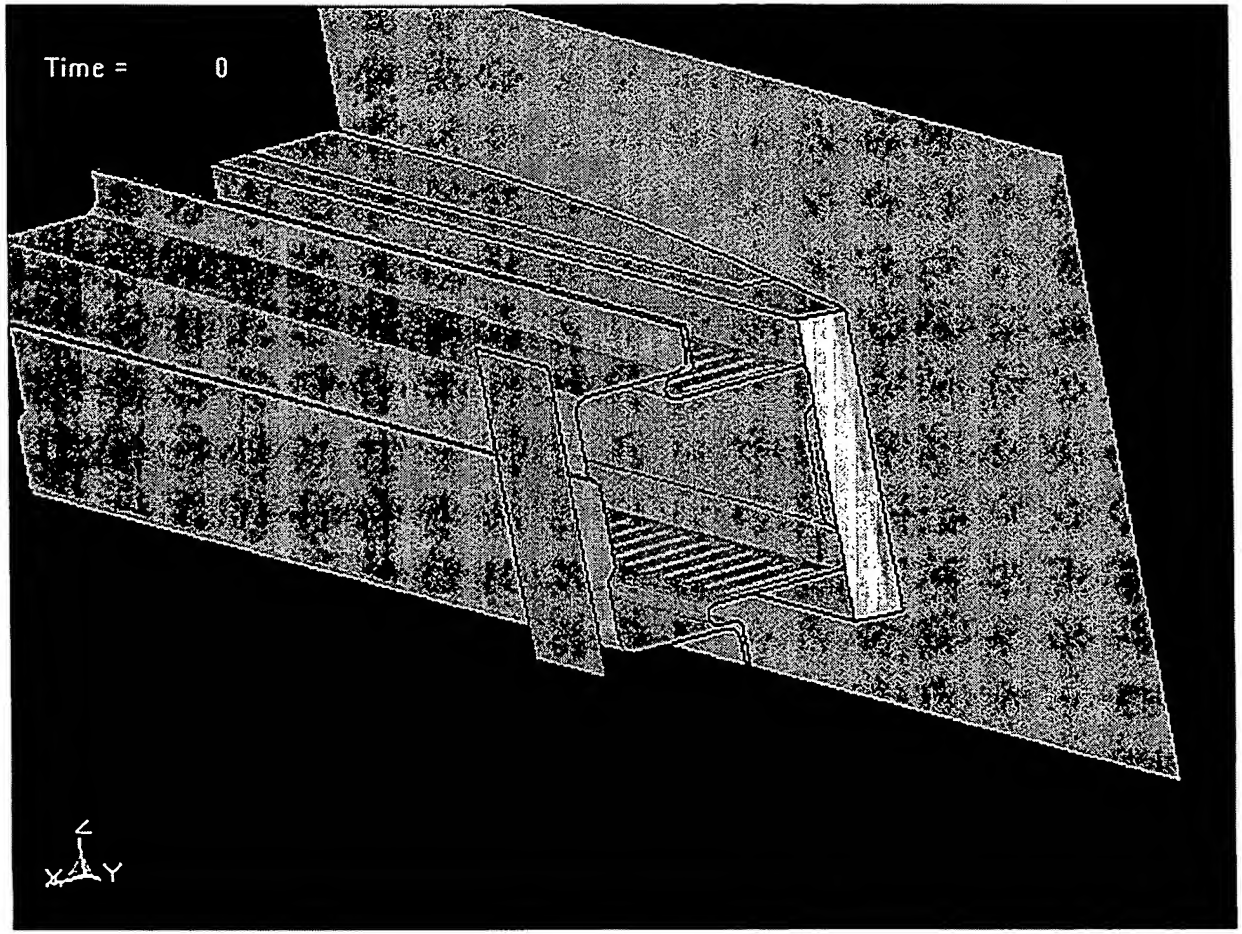

Revised Rib Pattern

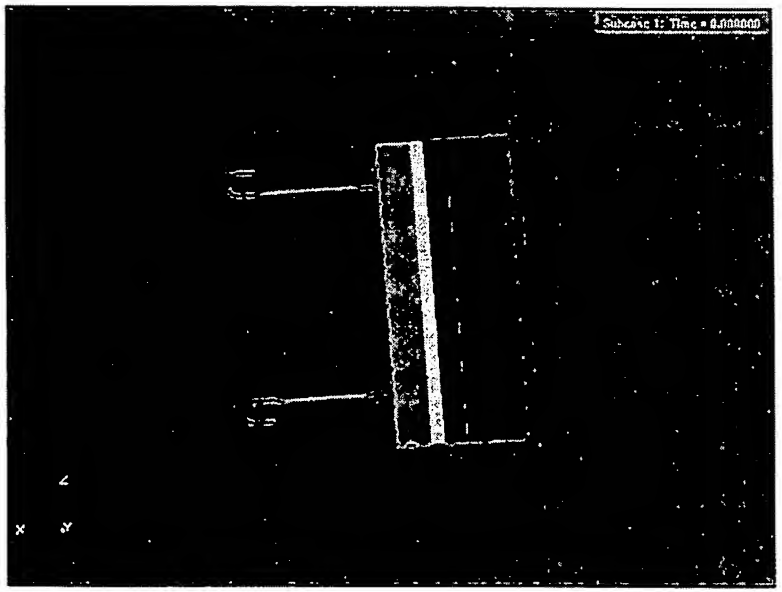

EMB Development
r031015:rib design per bruce/ 4t radius
r031014: rib design per bruce/ 2t radius
Vehicle mass = 3600lbs
Velocity = 5mph
Load (kN)
Displacement (mm)
0
20
40
60
80
100
120
140
160
0
10
20
30
40
50
60
70
80
90

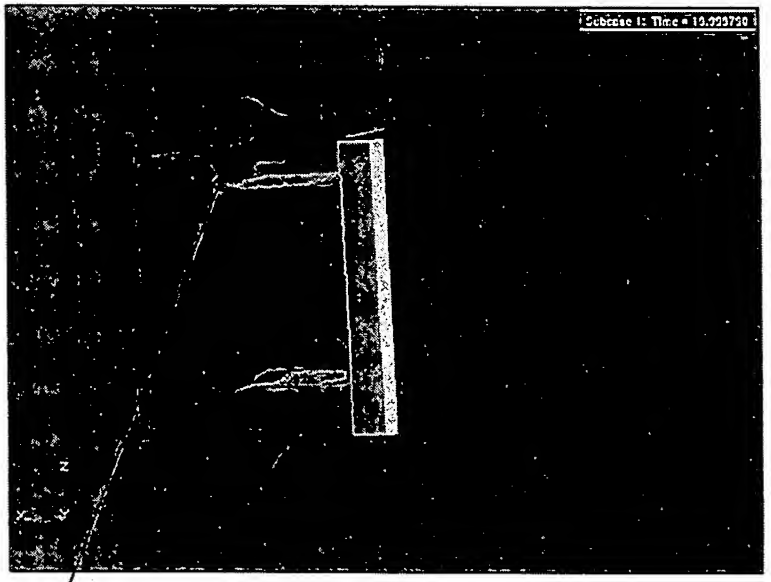
r031015
Flat Barrier Impact

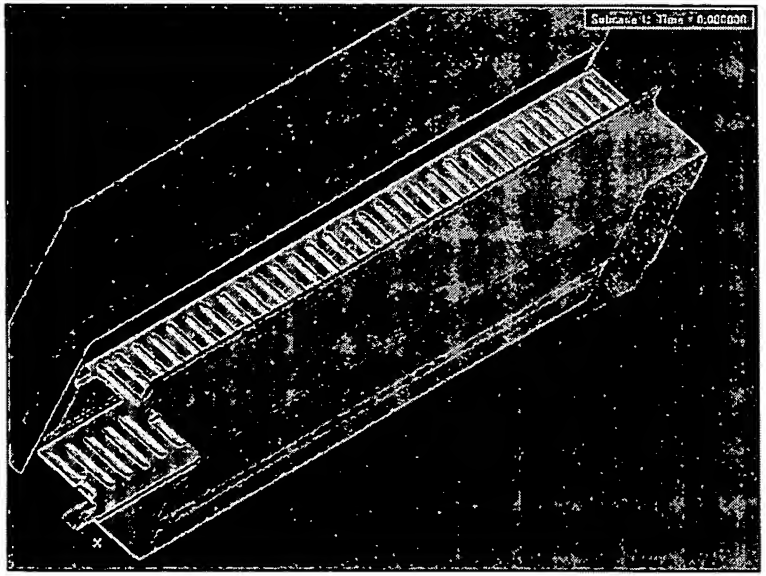


r031015
Flat Barrier Impact

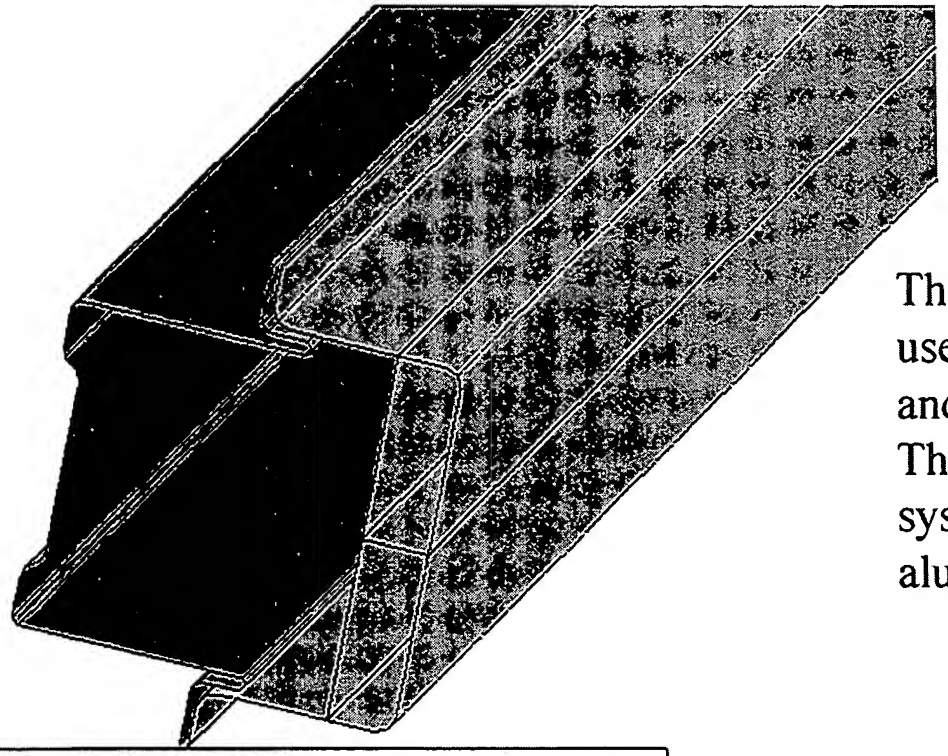






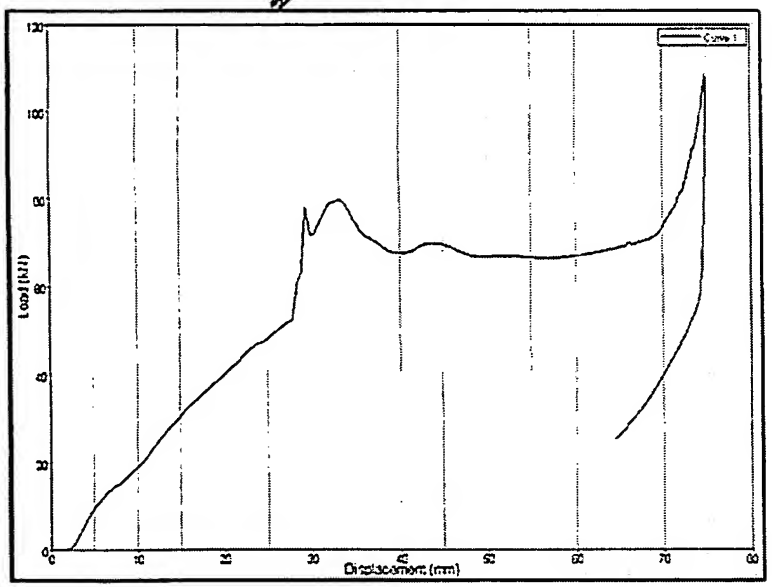


Roll initiates at end of rib



Aluminum Extrusion

This is early design in aluminum that used aluminum extrusion as the base and steel as the front face of the beam. This could be considered as a Hybrid system due to the mixing of steel and aluminum.

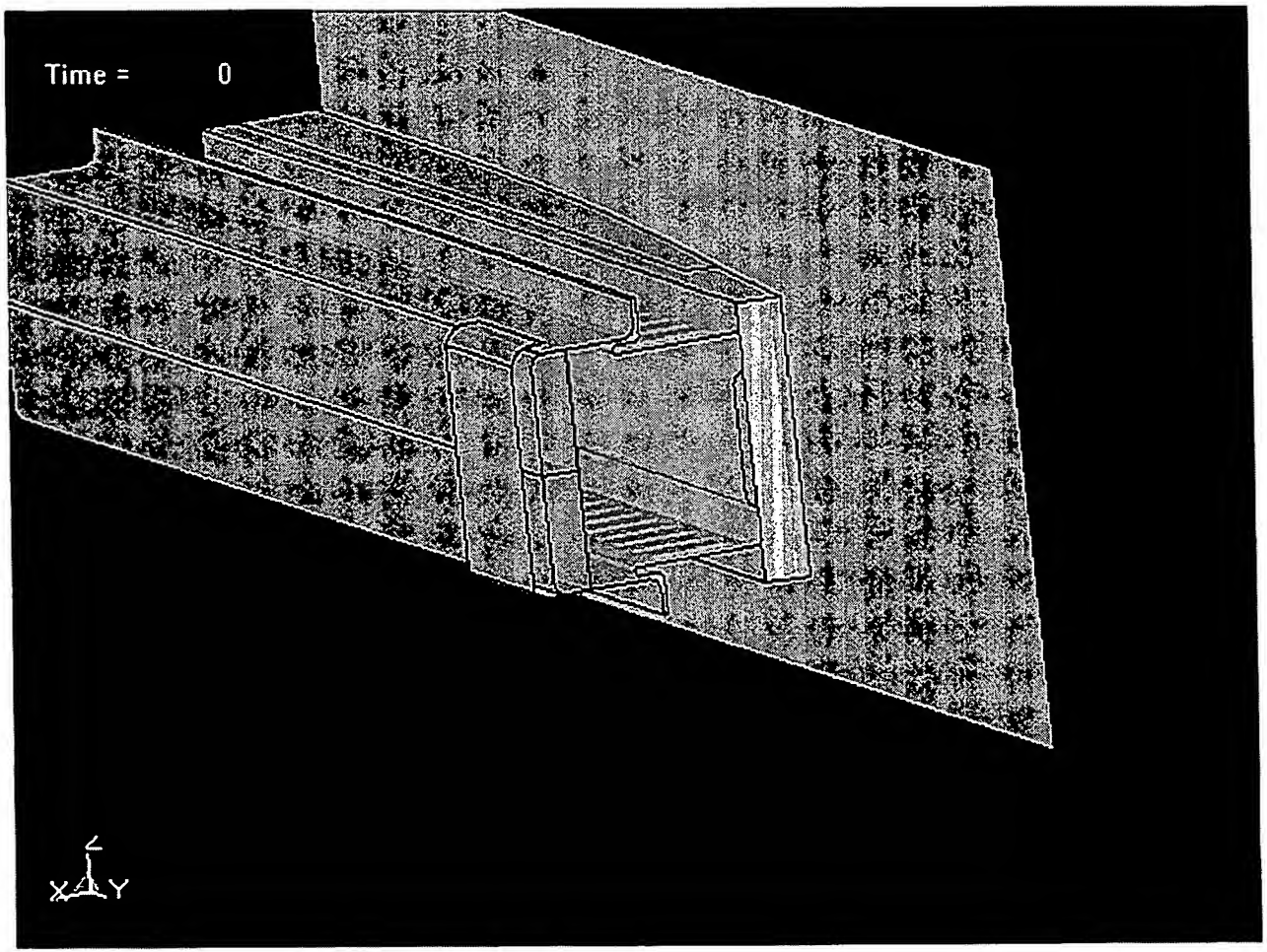


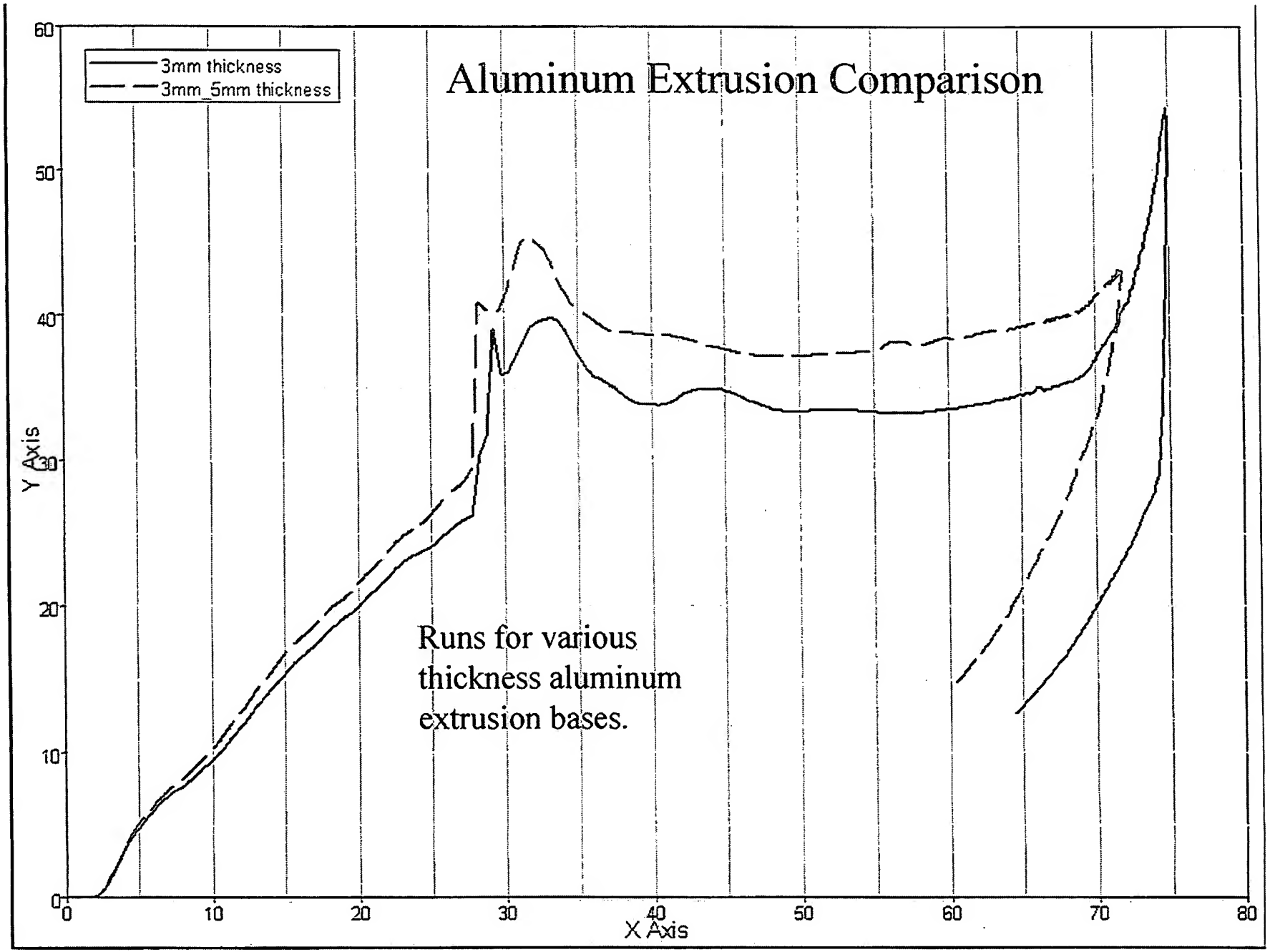
Notes:
(r031016)

Extruded Base:
3.0mm Aluminum

Front Face:
1.2mm, 50ksi steel

Base+front face mass = 5.4kg


Time = 0
Z
X
Y

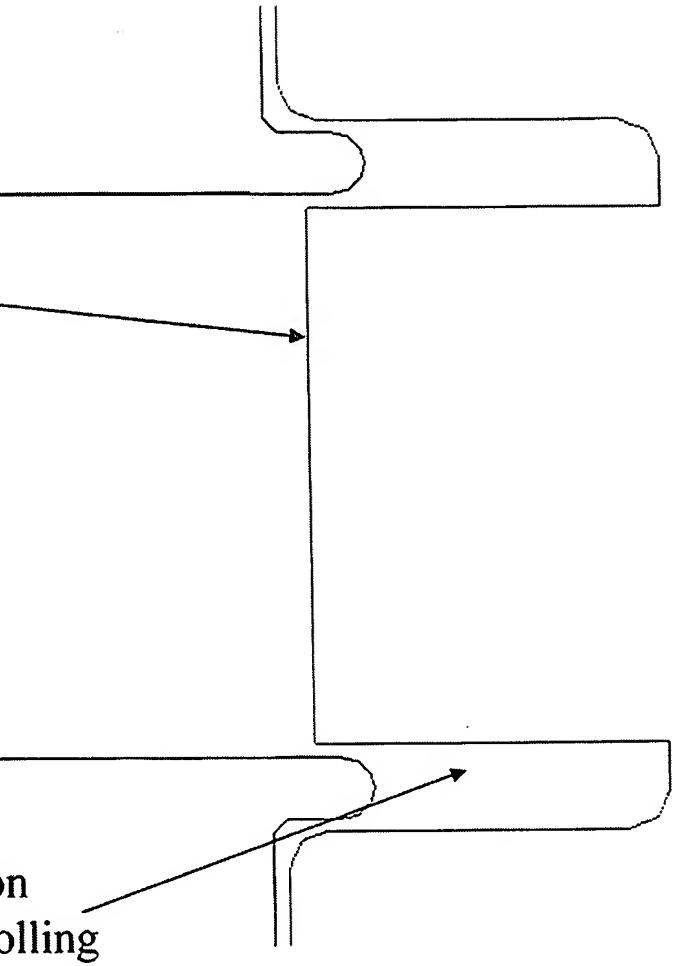

Aluminum Extrusion Comparison
3mm thickness
3mm_5mm thickness
Runs for various thickness aluminum extrusion bases.
Y Axis
X Axis
0
10
20
30
40
50
60
70
80

EMB "W" Base Design

Steel Design

Base:
Material = 2.5mm, 80ksi

Front Face:
Material = 1.2mm, 50ksi



"W" base adds stiffness to the base section and provides a guide and support to the rolling radius of the front face.

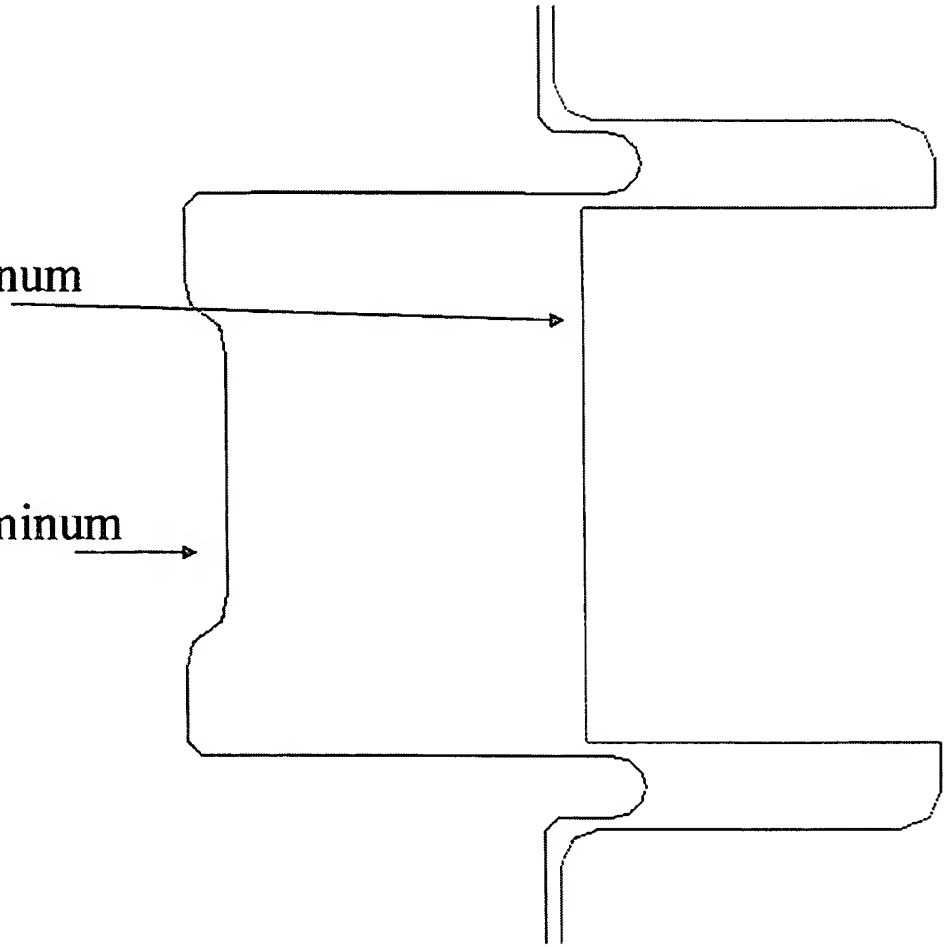
EMB "W" Base Design

Aluminum Design

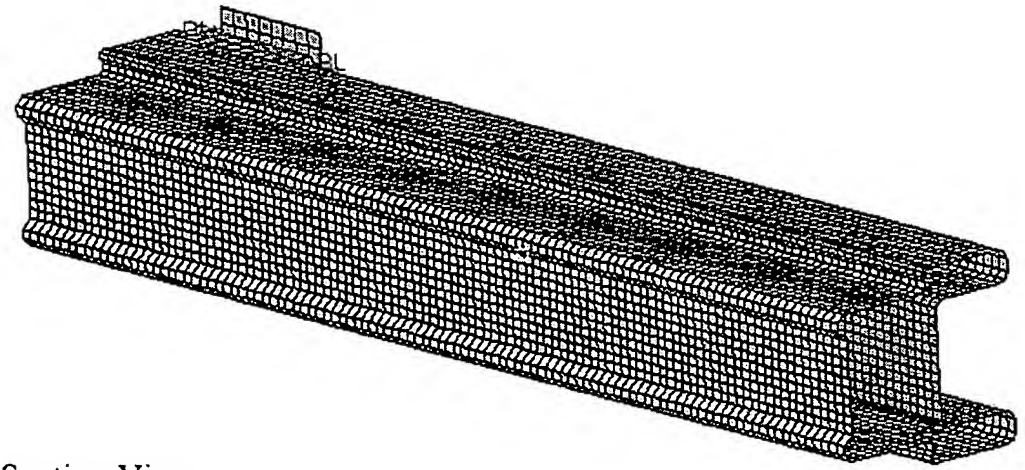
Base:
Material = 4mm, Aluminum
Mass = 3.38kg

Front Face:
Material = 1.2mm, Aluminum
Mass = .874 kg

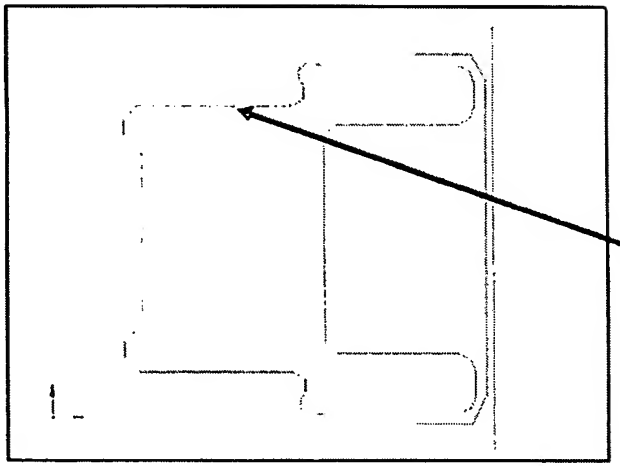
Total Mass = 4.254 kg



One Piece Extrusion Design



Section View



Material = 6013t4

Tapered wall for stiffness
to prevent premature buckling

One Piece Extrusion Design
Using various grades of aluminum